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IN THE FIELD

Field Museum
Member Magazine

100

IN THE FIELD

Field Museum Member Magazine

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PUBLISHER
Charles L. Katzenmeyer, Vice President, Institutional Advancement

EXECUTIVE EDITOR
Usha Subramanian, Senior Director Membership & Visitor Services

EDITOR
Chandler Garland, Communications Specialist, Institutional Advancement

EDITORIAL TEAM
Vicky Sanchez, Director of Membership; Jenna Lieblich, Membership Manager; Mark Alvey, Academic Communications Manager; Kate Golembiewski, PR and Science Communications Specialist

DESIGNER
Bark Design, barkdesignchicago.com

PHOTO SPECIALIST
Nina Cummings, Library Photo Archivist. All images © The Field Museum unless otherwise specified.

ON THE COVER
Opening day visitors on May 2, 1921.
FIELD MUSEUM

Let us know your thoughts about *In The Field* magazine. Email your comments to ITF@fieldmuseum.org

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CHICAGO, IL 60605-2496
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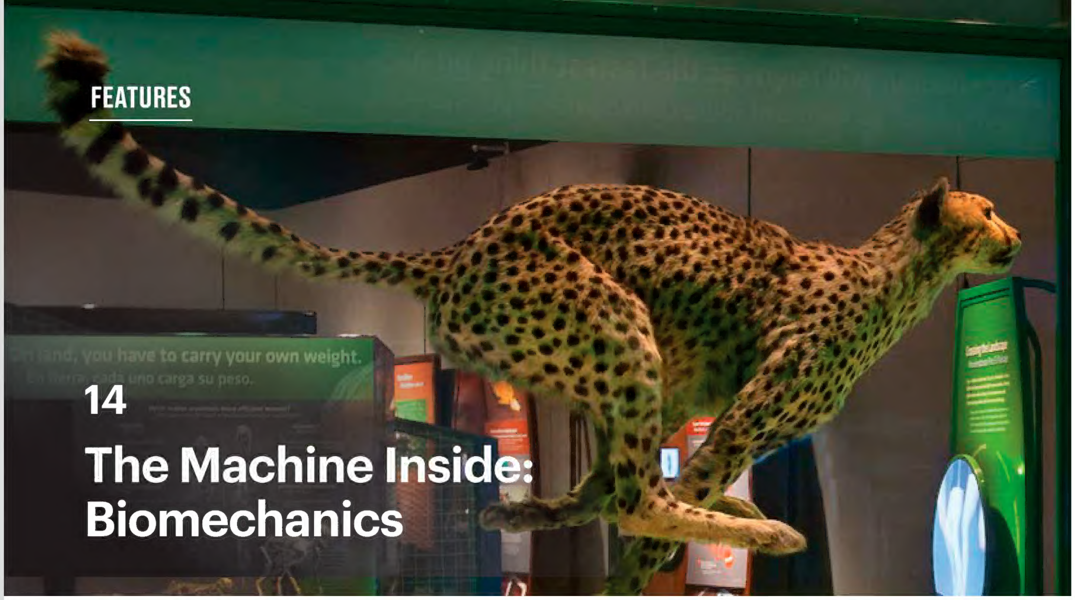

14
The Machine Inside: Biomechanics

06
Celebrating 100 Years in Our Lakefront Home

18
Be a Scientist Like Jane Goodall

24
What a Glass Bead Can Tell Us About Ancient Economies and Trade

CONTENTS

03
Welcome New Trustees!

04
New Associate Curator of Herpetology: Sara Ruane

05
What Are Tropical Biologists Doing in the Kankakee River?

10
Rewriting the History of Spines

11
How to Survive a Climate Crisis

12
Stories from British Columbia

13
Field Museum Learning Connection

16
The Volcano and the Mouse

17
Biomechanics of Bones

20
70 Years of Plastic in the Water

21
EXPLORE: Science Action in the Grainger Science Hub

22
Dive Deep into our Cosmic Origins with the Atom Probe

23
The Mystery of the Quartz Crystals and the Fossil Bird

27
Member Opportunities, Museum Hours

Dear Friends,

FIELD MUSEUM

Summer has arrived, and we can't wait to welcome you back to the Museum. Your membership is a passport to all things Field, including the new, must-see exhibition *Becoming Jane: The Evolution of Dr. Jane Goodall*. The exhibition has a limited run (through September 6) and is selling out on some days—if you haven't already reserved your free Member tickets, now is the time.

We have extended Member-only early hours on Saturdays (8-9:30 am) through Labor Day, offering you a chance to see the new exhibition and enjoy quiet moments in all of our galleries. The Bistro is also open early so that you can start your Saturday with coffee and a relaxed visit to the Museum. I hope you will take advantage of these special opportunities.

2021 marks the centennial of our landmark building on the lakefront. As you may know, the Field's first home was the Palace of Fine Arts on the site of the 1893 World's Fair in Jackson Park. Construction on our current home started in 1915 and the "new" Field Museum opened on May 2,1921. In the last 100 years, we have welcomed more than 130 million visitors—inspiring in them curiosity and a love for the natural world.

A century later, this building holds the Field's remarkable (and growing) scientific collection and serves as home base for more than 140 scientists and scholars who find out more about the world around us. It is also your home for exploration and inspiration.

Join us as we commemorate the Centennial with special member programs and activities throughout the year to come. We all look forward to seeing you at the Field Museum very soon.

Warm regards,

Julian Siggers

Julian Siggers, PhD
President and CEO

WOMEN IN SCIENCE
50 FEARLESS PIONEERS WHO CHANGED THE WORLD
WRITTEN AND ILLUSTRATED BY RACHEL IGNOTOFSKY
ROSALIND FRANKLIN
FIELD MUSEUM

The Women in Science collection celebrates the achievements of the intrepid women who have paved the way for the next generation of female scientists!

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Shop the collection in-store and online at **store.fieldmuseum.org**

1

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4

5

WELCOME NEW TRUSTEES!

The Field Museum's Board of Trustees are responsible for ensuring the capacity of the Museum to fulfill its mission for generations to come. Representing a cross-section of Chicago's civic, corporate, professional, and philanthropic communities, they provide leadership and oversight regarding strategic direction and financial resources. The Field graciously welcome the following members:

1. Robert Blackwell, Jr., *Chairman, EKI-Digital*
2. Sandra Deromedi, *Civic Leader*
3. Margery Kamin Feitler, *Civic Leader*
4. Jorge M. Leon, *Partner, Michael Best*
5. Scott Rafferty, *Director of Investor Relations, Sterling Bay*

(Left) Sara Ruane holds a live snake in the field.

(Below) Associate Curator of Herpetology Sara Ruane collects a snake specimen on her way to a wedding.

SARA RUANE

NEW ASSOCIATE CURATOR OF HERPETOLOGY: SARA RUANE

BY KATE GOLEMBIEWSKI, PUBLIC RELATIONS

Most people, if they're on their way to a wedding and dressed to the nines, would probably just keep going if they drove past a dead snake on the road. But the Field's new associate curator of herpetology Sara Ruane, PhD, isn't most people.

"I never, ever let a dead snake go to waste, because I can always preserve the DNA and study it later," said Ruane, who is joining the Field Museum this summer after serving as an assistant professor of biology at Rutgers University. "So I hopped out of the car to pick it up and put it in a cooler, and then headed to the wedding."

The passion for snakes that led Ruane to the Field Museum started when she was a kid. "My grandmother was an amateur naturalist, and a really important part of my childhood was flipping over rocks with her to see what was underneath them," she said. Ruane remembers catching frogs and garter snakes for her own little museum.

Now, instead of garter snakes, Ruane catches poorly-known species from places like Madagascar and New Guinea to learn more about how they evolved and the role they play in their ecosystems. "I'm interested in what generates the diversity we see in snakes," she said. "Despite having no legs, snakes fill essentially every ecological niche. There are sea snakes that have conquered marine environments, snakes that burrow underground, snakes that can flatten out their rib cages to glide from tree to tree."

In addition to her research on snake evolution and ecology, Ruane is excited about sharing her love of snakes with Field Museum donors, members, and visitors. "My favorite thing is cracking the 'snakes are scary' feeling that a lot of people have, and making them have even just a little tiny bit of appreciation," said Ruane. "Once they learn something about snakes that they didn't know before and suddenly have even a little bit of interest or a little bit of appreciation? To me, it's the best."

WHAT ARE TROPICAL BIOLOGISTS DOING IN THE KANKAKEE RIVER?

BY ANDREW GEORGE, PHD, NSF POSTDOCTORAL FELLOW, KELLER SCIENCE ACTION CENTER AND GANTZ FAMILY COLLECTIONS CENTER

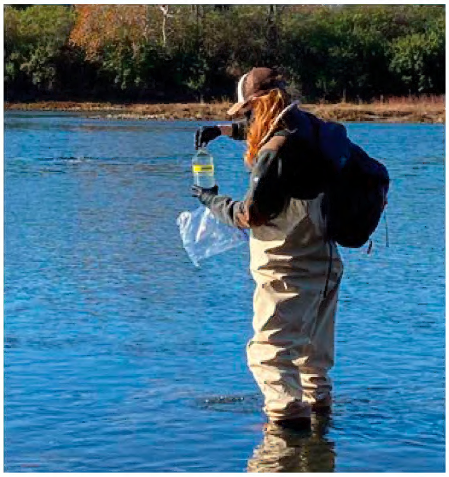
In the Northeast corner of Peru lies the Yaguas River Watershed, home to one of the most diverse freshwater fish assemblages in the world. Field Museum researchers in the Keller Science Action Center have a long history of working with local South American communities to inventory the biodiversity of this region and advocate for its protection. Their efforts led to the establishment of Yaguas National Park in 2018. Some previously inventoried sites have been incorporated into Yaguas National Park while others remain unprotected today, creating a rare opportunity for scientists to directly assess how park conservation efforts have impacted biodiversity. I recently began a National Science Foundation fellowship to do just that. With Fishes Collections Manager, Caleb McMahan, PhD, and Keller Center Conservation Ecologists Lesley de Souza, PhD, and Michelle Thompson, PhD, I will be resampling the fish and herp diversity at sites within and outside of Yaguas National Park.

Our team will employ traditional collection methods, and an exciting new technique termed environmental DNA or "eDNA," which allows for noninvasive detection of species using water samples. To prepare these methods for Peru, the team spent three days in November 2020 conducting a pilot study. Masked-up and wading through the frigid Kankakee River, we searched for fishes and herps. We were joined by former Fishes Collections Manager Phil Willink and University of Illinois ecologists Eric Larson, PhD, and Amanda Curtis. The team pulled seine nets and collected water samples at 11 sites along a 40 mile stretch of the river. Twenty-four species were identified, including the endangered starhead topminnow (*Fundulus dispar*) and juvenile eastern musk turtles (*Sternotherus odoratus*).

Back in the lab, tiny organic particles (such as fish scales and mucus) were filtered out of the water samples for eDNA analysis. Sequencing these particles will allow us to detect the presence of any species missed by our seine nets. These data will provide a more comprehensive understanding of the fish and herp communities in our local Kankakee River and allow the researchers to experiment with eDNA techniques before applying the method to the remote Yaguas River ecosystem. Ultimately, the genetic techniques we are honing right here in Illinois will become valuable additions to the Museum's biological inventories around the world.

(Below) Andrew collects a water sample from the Kankakee River for eDNA analysis.

(Bottom) Juvenile eastern musk turtles, Sternotherus odoratus, *from the Kankakee River.*



ANDREW GEORGE

Celebrating 100 Years in Our Lakefront Home

2021 marks the 100th Anniversary of the Field Museum's iconic lakeshore building.

For the past century, this grand structure has captured the imagination of nearly 137 million visitors—inviting them on a journey around the world and through time to understand nature and culture.

Join us as we honor and celebrate a century of research, conservation, and public learning.

(Left) Curator of Flowering Plants Rick Ree, PhD collects specimens in the Hengduan Mountains, China. © Deren Eaton.

(Above) Botany Research Associate Margery Carlson, PhD kneels next to plant specimens she collected on an expedition to South America in 1955.

(Right) A Chicago 4-H group photographs the Mastodon on a field trip to the Field Museum, 1958.

(Far right) Students explore the Mastodon in the Griffin Halls of Evolving Planet *on a field trip. © Zachary Johnston.*

(Above left) Team members observe animal behavior on an expedition in 1929.

(Above) Javier Maldonado reviews the day's notes of specimens observed and collected during a rapid inventory in Amazonian Colombia. © Jorge Enrique Garćia Melo.

GROUND SLOTHS AND GLYPTODONTS ORIGINATED IN SOUTH AMERICA DURING THE CENOZOIC

Centennial Adoption Opportunities

The Field Museum is home to more than 40 million artifacts and specimens, of which only 1% are on display. The vast majority of our collections behind the scenes fuel research of scientists at the Field Museum and around the world.

HOME FOR THE HOLOTYPES

$5,000

The Field Museum is home to many type specimens, which are irreplaceable specimens that help define a species when it is new to science. Holotypes are special because they are a single type specimen upon which the description and name of a new species are based. In recognition of a $5,000 new or additional gift to the Field Museum, we are pleased to offer digital recognition in the official specimen record in our Collections Catalogue. Adopt one of the following signature Field Museum type specimens:

- **Tully Monster**, Illinois State fossil
- **Brachiosaur bones**, casted to create the model mounted outside the Field Museum
- **Beetle collected by Charles Darwin**, recently rediscovered by a digitization volunteer in our collections

LOCAL LEGENDS

$2,500

The Field Museum is home to many specimens that represent the natural history of Chicago and the surrounding region. In celebration of a new or additional gift of $2,500 to the Field Museum, you will receive digital recognition in our collections database as an adopter of one of the following "Chicago" specimens:

- ***Thismia americana***, a plant that was only found prior to 1916 in the Chicago region—the Field Museum has 2 of only six specimens ever collected.
- **Gynandromorph (dual-gender) Butterfly**, locally collected and extremely rare
- **Chicago Cougar**, known from local news headlines

Donors receive:

- Invitation to Centennial Birthday Party (September 14)
- Invitation to an exclusive preview of *Wild Color* (opening October 22)
- Invitation to an event featuring adopted specimens not typically on display in the Museum (October 2)
- Access to related lecture by Field Museum expert
- Certificate of Centennial adoption for selected specimen
- Limited edition double-sided Centennial puzzle

In honor of our building's Centennial, we are proud to offer an opportunity to adopt one of the many specimens in our collections, either for yourself or as a gift for the natural history enthusiast in your life. Recognition is offered for one year from the date of adoption.

The Field Museum has more than 20 million zoological specimens of which 2 million have been digitally cataloged in our collections database, accessed by scientists all over the world.

Donors making new or additional gifts at the levels below will have the opportunity to **digitally adopt** a specimen, especially selected from one of the Field's collections below:

WIND BENEATH OUR WINGS

Adopt a bird

$1,500

SCALE YOUR SUPPORT

Adopt a fish

$1,000

FLUTTERY PHILANTHROPY

Adopt a butterfly

$500

REP(TILE) THE FIELD MUSEUM

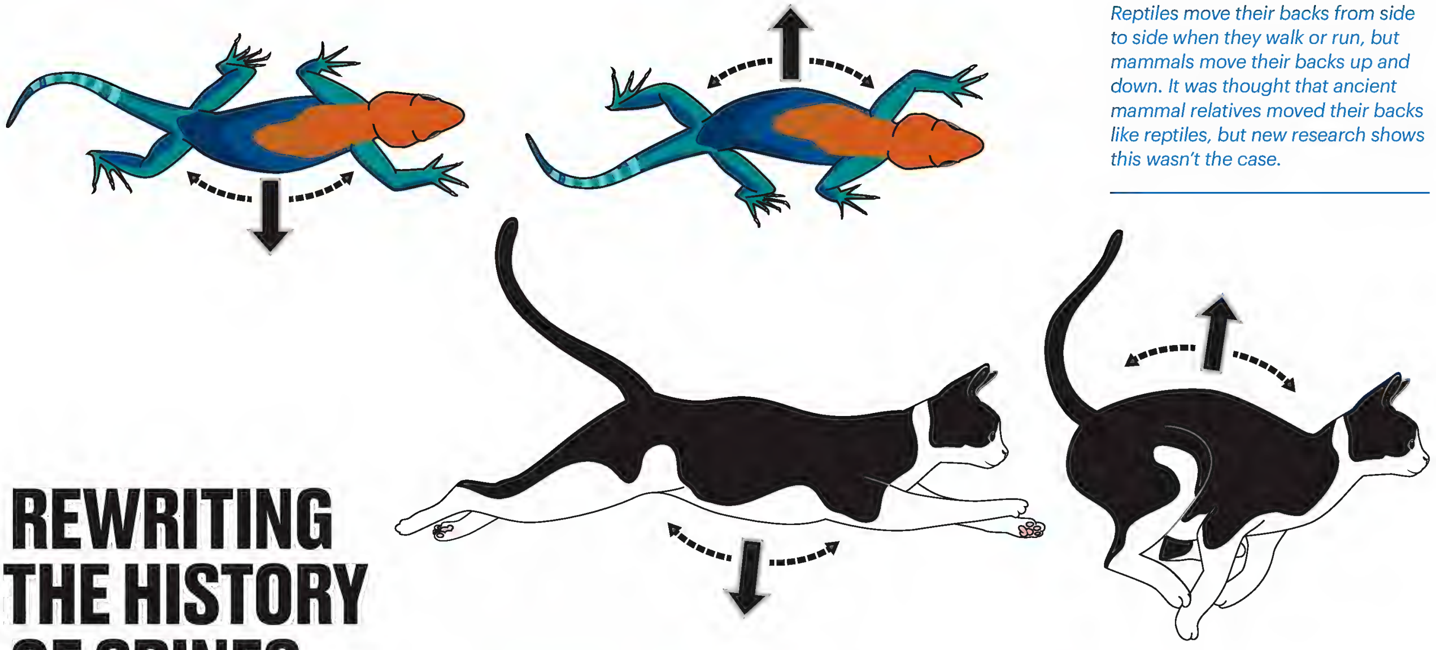
Adopt a reptile

$250

Donors receive:

- Digital recognition in the Field Museum's publicly searchable collections records
- Personalized digital certificate of Centennial Adoption with unique specimen details and official collections identification number
- Invitation to an adopter event featuring some signature specimens, rarely on public display (October 2)
- Invitation to a lecture by Field Museum expert
- Commemorative Centennial souvenir

To make a gift for a Centennial adoption visit fieldmuseum.org/centennial or call 312.665.7777.

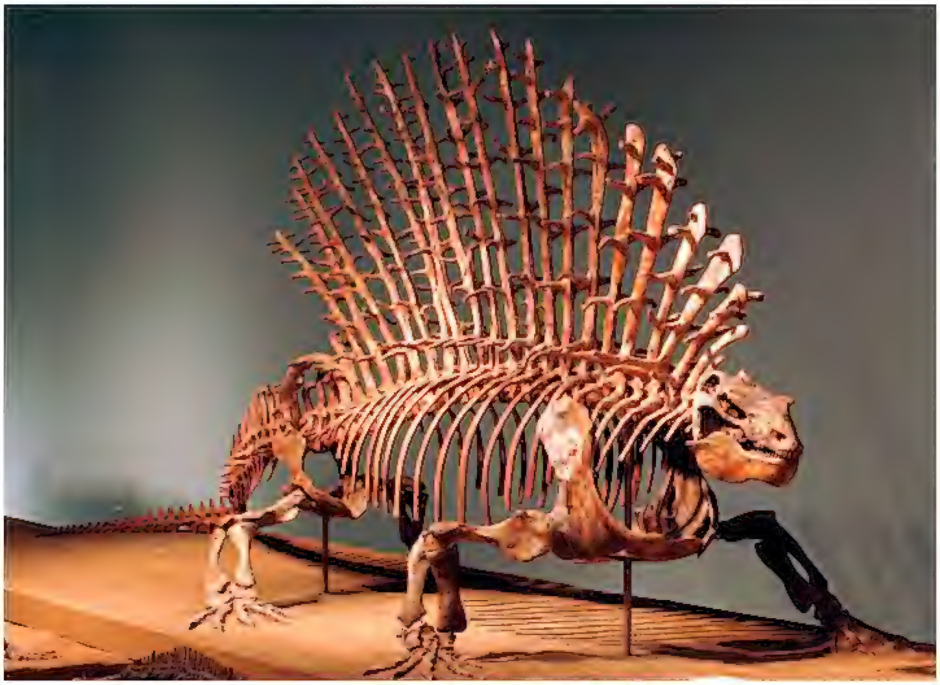


Reptiles move their backs from side to side when they walk or run, but mammals move their backs up and down. It was thought that ancient mammal relatives moved their backs like reptiles, but new research shows this wasn't the case.

STEPHANIE SMITH

REWRITING THE HISTORY OF SPINES

BY KEN ANGIELCZYK, PHD, MACARTHUR CURATOR OF PALEOMAMMALOGY, NEGAUNEE INTEGRATIVE RESEARCH CENTER



A skeleton of the ancient mammal relative Edaphosaurus *on display in Evolving Planet. Animals like* Edaphosaurus *had stiffer backbones than living mammals or reptiles.*

KEN ANGIELCZYK

The next time you take your dog to the park or your cat gets the zoomies, watch how they run. You'll notice they move their backs up and down. That movement is a quintessential feature of modern mammals, and is related to our upright limb posture. However, the most ancient relatives of mammals, who lived about 300 million years ago and are called synapsids, held their limbs away from their bodies. This posture gives them a superficial resemblance to modern lizards and crocodiles, and paleontologists have long thought that synapsids also moved their backs from side-to-side as they walked, like a lizard. However, my new research, along with my collaborators at Harvard University and Duke University, shows this wasn't the case.

My colleagues and I examined how the 3D shapes of the individual backbones, or vertebrae, relate to the possible movements at the joints between the vertebrae in modern mammals and reptiles. We then used those data and a new statistical method to predict what movements were possible in the backbones of ancient synapsids.

Reptile backbones emphasize flexibility near the hips, which is important for side-to-side bending when walking. Mammals emphasize a mixture of stiffness (reflecting the fact that the backbone near the hips is limited to up and down movements), and flexibility of the chest region, which facilitates bending associated with behaviors like grooming fur. Conventional wisdom predicts that early synapsids should have had backbone movements similar to modern reptiles, with later species becoming progressively more mammal-like. Instead, our team found that synapsid backbones emphasized stiffness to a degree that was unlike any of the living groups, with a secondary emphasis on bending near the hips. Furthermore, the evolutionary transition from early synapsids to mammals took a distinct path through functional "space." At no point in their history did synapsids have backbones that functioned like those of modern reptiles.

This work is rewriting our understanding of one of the great transitions in mammalian evolution and underscores the importance of applying new methods to the vast archive of data housed in museum collections.

HOW TO SURVIVE A CLIMATE CRISIS

BY RYAN WILLIAMS, PHD, ASSOCIATE CURATOR, NEGAUNEE INTEGRATIVE RESEARCH CENTER

Two thousand years of human adaptation to climate change in the Andes mountains teaches us something about how we as humans respond to environmental crises, and sometimes how we fail. A Field Museum research program stretching back over three generations of Museum curators working in Peru has resulted in an unprecedented level of detail on how climate change has affected the northern fringe of the world's driest desert, the Atacama.

Early farmers lived in small communities along the narrow river floodplains that crossed the dry desert from the mountain peaks to the Pacific Ocean. As populations grew, increasing dependence on agriculture stretched scarce water resources further than ever before. By 300 CE, long-term drought may have affected the local agricultural systems. Possibly coupled with plagues and disease, the drought caused a demographic collapse that may have lasted 200 years. Population recovery was linked to new immigrants to the region bringing new agrarian technologies.

The Wari state expanded into the underdeveloped upper valley region between 500 and 600 CE, introducing high elevation terracing and mountain slope canals that opened new agricultural lands to production. This was a drought tolerant technology that increased production with less water than the river floodplain farming. At the same time, a diaspora of high plains migrants from the Lake Titicaca basin began settling the plains above the river below the Wari settlers, ushering in a period of cosmopolitan interaction in this desert fringe under a relatively stable climate.

At the beginning of the 2nd millennia CE, shifting climate plunged the Andes into a severe drought that would last for generations. It crippled the production systems of the lower valley Tiwanaku and may have exacerbated social tensions in Wari communities, leading to the political collapse of both entities. The highland irrigation technologies, adaptive to drought, lived on in the new agricultural systems built by the survivors who lived in independent, fortified villages subject to raiding by marauders in the times of lawlessness that ensued. It was within this context that the mighty Inca empire emerged and consolidated power, building on the drought adaptive technologies of their predecessors.

Lessons from the past instruct us that crises tend to converge and overwhelm societies. Climate vulnerability, if left unchecked, can pair with other destabilizing factors—such as extreme inequality and pandemic disease—to debilitate the political unity that allows wealth to build and people to thrive. Decades of Field Museum research illustrate that only by confronting the multiple challenges that face them were earlier communities able to persevere and flourish.

YAN WILLIAMS

Abandoned Inca agricultural terraces at Camata, Moquegua, Peru reflect the engineering ingenuity that early states used to confront ancient climate change in the high Andes.

Stories from British Columbia

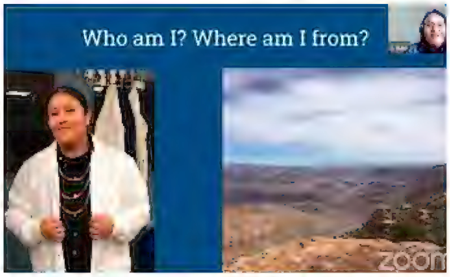
When you first walk into the museum, you can't help but notice the monumental red cedar poles that stand over 20 feet tall. Before coming to Chicago in 1893, they stood towering above the houses in villages on Haida Gwaii, home of the Haida Nation, now part of British Columbia, Canada. They were testaments to the wealth and influence of a single family. The carvings on the pole are packed with meaning: each shows a family's crest, shares a popular legend, or honors an important person or event. These poles stood in front of the houses of two chiefs—NEnkaidsuglas and Tl'aajaang Quna. If you looked through the gap at the base of the right pole you'd be peering into someone's home.

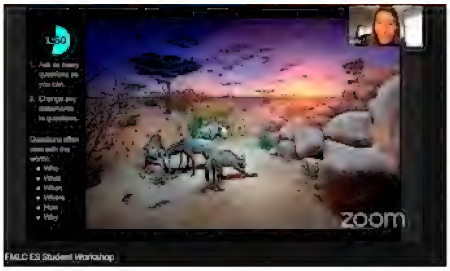
On your next visit to the Field Museum, stop by the *Marilynn Alsdorf Hall of the Northwest Coast and Arctic Peoples* to learn more about the people who made these works of art.

(Left) Collections Assistant Jim Louderman showcases live insects and arachnids during a Elementary Scientist Chat.

(Below) Conservation Technician, J. Kae Good Bear talks about the work she does in the collection and tells the story of her heritage to Elementary Schoolers.

(Bottom) School Learning Experiences Coordinator, Kyla Cook leads a Teacher Professional Development Virtual Workshop.





FIELD MUSEUM LEARNING CONNECTION

BY LAUREN WAGNER, LEARNING CENTER

In response to the challenges faced by students, teachers, and families in one of the most uncertain academic years on record, Learning Center staff launched the Field Museum Learning Connection—a brand-new classroom partnership program—in fall 2020. This program connects Pre-K through 12th grade classrooms with museum educators, scientists, collections, and resources through meaningful and authentic virtual learning opportunities. The program was designed to flexibly support teachers and students in remote, blended, and in-person learning environments. Teachers are invited to participate in a series of interactive workshops to learn strategies to support student learning. Students will connect with Field Museum educators in virtual workshops to practice investigating scientific questions, making observations, developing inferences, and creating scientific drawings. Classrooms can also attend live-streamed chats with Field scientists and contribute to community science projects. Since its launch in late 2020, the program has been positively received by both teachers and students. One teacher's recent remarks (above) reflect sentiments shared by many.

> **"Being thrown into pandemic teaching was stressful enough, but when I was told the monolingual classrooms in my district were going to use a fun, online science curriculum and that the bilingual teachers would have to 'figure it out on their own,' I went into panic mode. Luckily at that very moment, a Field Museum email dropped into my inbox about remote student workshops, and they've been a lifesaver. I've been grateful for the support and structure the workshops and professional development have provided."**
>
> –**Joyce Shimada**
> 2nd grade bilingual, Willard School

Over the 2020-2021 school year, more than 90 teachers and nearly 10,000 students from Chicago and nationwide had the opportunity to learn and engage with Museum content, collections, and staff through this program.

Are you an educator or know an educator who would be interested in participating in our Field Museum Learning Connection cohort next Fall? Please email educators@fieldmuseum.org to learn more and sign up.

THE MACHINE INSIDE:

BIOMECHANICS

By Marie Georg

EXHIBITIONS

Living things use pipes, pressure, and pumps to transport air and fluids where they're needed most to keep every cell alive. To pump blood 7 feet up (2 m), a giraffe heart's blood pressure must reach 280/180. That's why the walls of the left side of the heart can be over 3 inches (8 cm) thick.

The Machine Inside: Biomechanics explores how living things are constantly under attack. Wind, water, and gravity threaten to tear them apart. Fortunately, life has responded with an arsenal of evolved materials and structures to defend against the environment. Visitors will see specimens of the most resilient biology nature has created—from the silk of spiders to the domes of turtle shells and skulls.

(Left) How does it run so fast? The very flexible spine allows the cheetah to cover 25 feet (7.5 m) with each stride.

(Below) The Machine Inside: Biomechanics *takes the viewer through a fierce battle of survival, examines how organisms journey through their environments, and explores evolutionary responses to our mysterious world.*

This fall, learn how living things use pipes, pressure, and pumps to move life-sustaining nutrients to every part of the body. Experience the pressures required to pump blood to a giraffe's brain in an interactive model, and see inside an insect as it breathes.

Learn how animals survive environments as extreme as the Sahara Desert and the Arctic Ocean. Explore an immersive theater experience showing natural innovations from the giant ears of desert foxes to the anti-freeze blood of Antarctic fish.

Meet the animals with the greatest bite forces on Earth and compare your grip strength to that of an ape. Then, journey beyond the firm ground into water and air. Feel yourself fly with different wing shapes in a full-body interactive experience.

Finally, to navigate, hunt, and communicate, living things must decode the world beyond themselves. Discover organisms with heightened senses, such as the moth that can smell for miles, and senses that reach beyond our five, such as the electroreception of sharks.

***The Machine Inside: Biomechanics* was developed by the Field Museum, Chicago.**

***The Machine Inside: Biomechanics* opens at the Field Museum on September 3, 2021. For information on exclusive member preview days see page 27.**

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DISCOVER

THE VOLCANO AND THE MOUSE

BY LARRY HEANEY, PHD, NEGAUNEE CURATOR OF MAMMALS, NEGAUNEE INTEGRATIVE RESEARCH CENTER

In June 1991, Mount Pinatubo in the Philippines erupted with a force ten times more powerful than Mount St. Helens. Eight hundred people lost their lives, lush tropical forest that had covered the mountain disappeared, and in the following months, powerful typhoons triggered landslides and ash flows that devastated farmland. Twenty years later, as documented in our recent publication in the *Philippine Journal of Science*, members of the Field Museum's Philippine Mammal Project conducted a thorough survey of the mammals on Pinatubo to determine the impact of the eruption. Given that the mountain was still mostly covered by ash fields, we expected native mammals to be all but gone, replaced by pest rats like *Rattus rattus*. Specifically, because of the catastrophe, conventional wisdom about rare species led our research team to predict that a little mouse known as Apomys sacobianus, previously known from a single specimen captured in 1956 on Pinatubo, would be extinct. Instead, we found that native mammals of all sizes were thriving and pest rats were rare. And specifically, our team showed that Apomys sacobianus had utterly defied expectations and was the most abundant mammal on the mountain.

In retrospect, perhaps the mouse's survival should not have surprised us so greatly. Our Philippine project, begun at the Field Museum in 1988, has shown that the Philippines is home to the world's greatest concentration of endemic species of mammals. Luzon Island, where Pinatubo is located, has about 56 native species of non-flying mammals, 93% of which are endemic–they live nowhere else in the world (and our project has discovered 28 of these!).

Elsewhere on Luzon, our studies have shown that in natural or not seriously degraded habitat, native species of small mammals are competitively superior to non-native pest rats—not, as textbooks suggest, easily replaced by the pest rats. Our genetic studies suggest a likely reason: the Pinatubo volcano mouse's ancestor arrived about 8 million years ago, which has allowed natural selection lots of time for the mice to adapt to their local conditions. Geological data show that Mt. Pinatubo began erupting over a million years ago, and in just the last 35,000 years, it has had at least seven major eruptions, each larger than the one in 1991. Now consider the fact that the vast majority of the Philippine archipelago is volcanic in origin–and that the islands are struck by an average of 20 typhoons each year. Thus, its no great surprise that the native animals have adapted to survive environmental catastrophes.

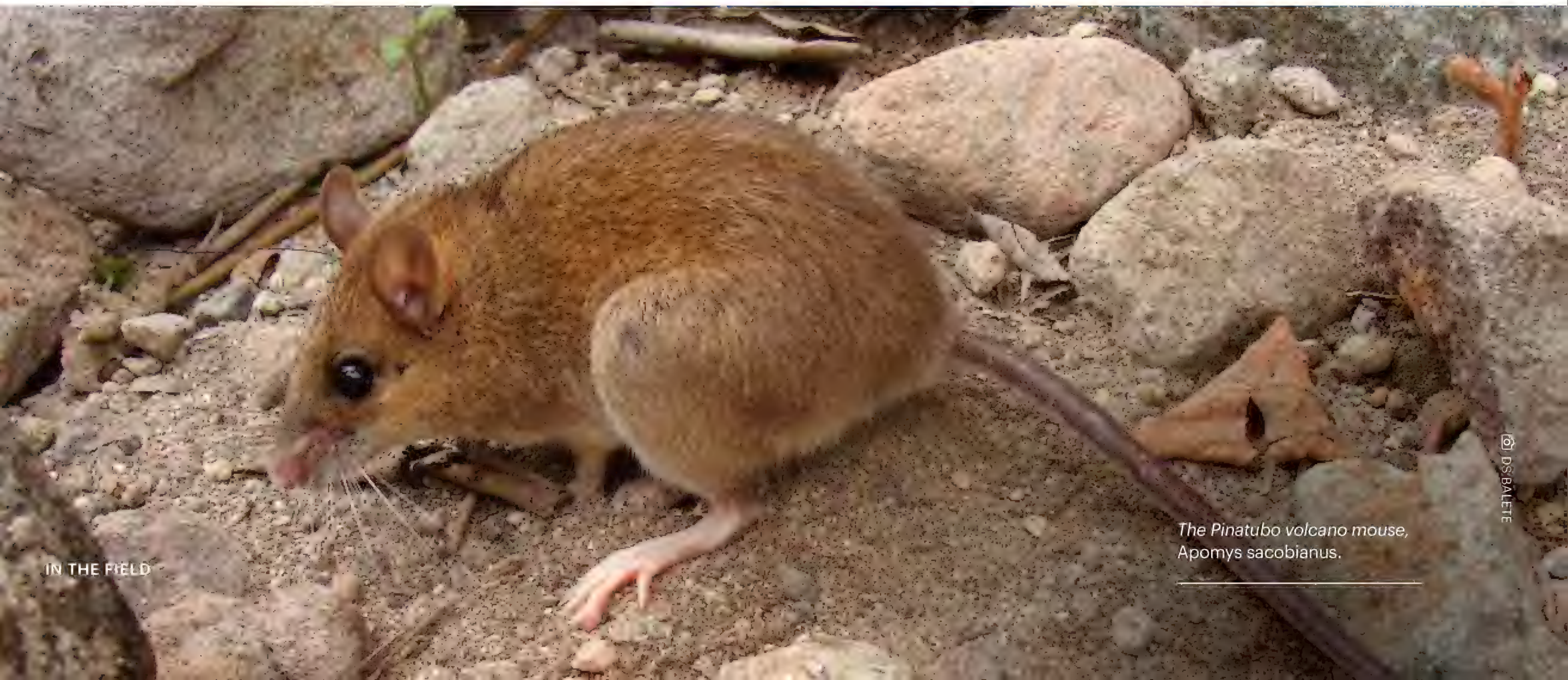
Sometimes Field Museum biodiversity research surprises us by finding good news like how some native species that live only on a single tropical mountain, like this one, have evolved to survive repeated environmental catastrophes.

The June 12, 1991 eruption column from Mount Pinatubo taken from the east side of Clark Air Base.

DAVID HARLOW, UNITED STATES GEOLOGICAL SURVEY

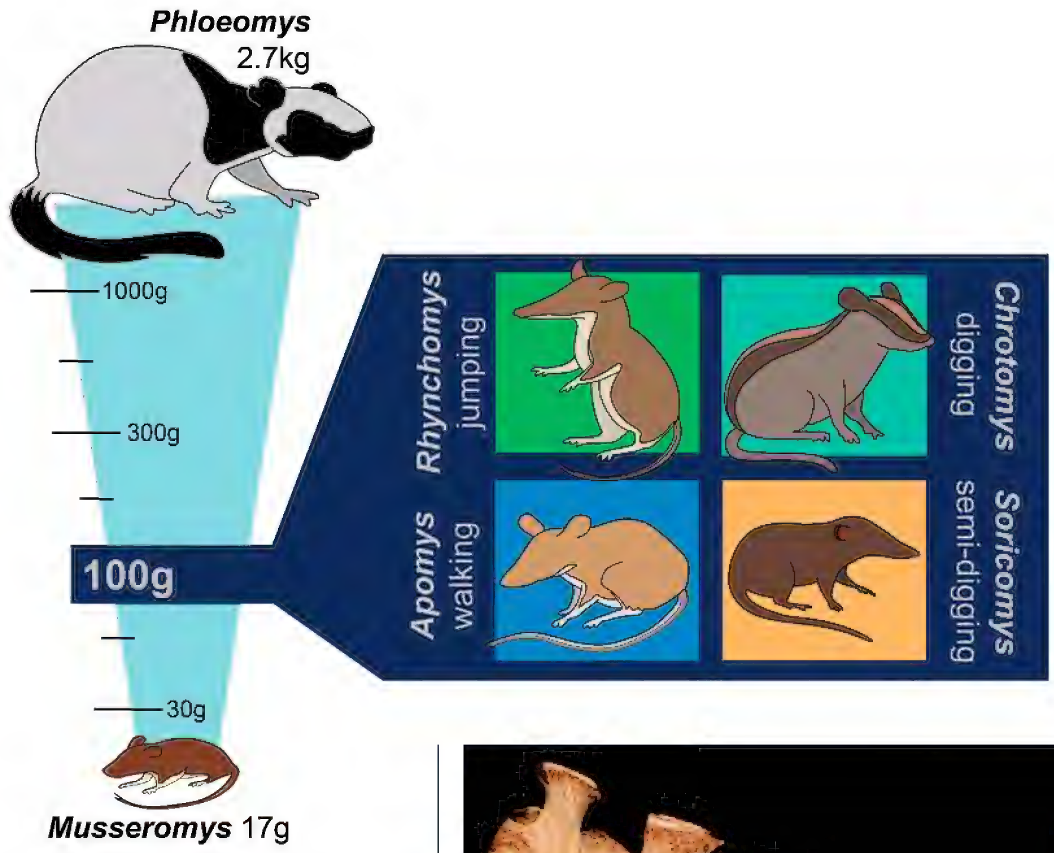
The Field Museum's team on Pinatubo was led by long-time Research Associate Danny Balete.

DS BALETE



The Pinatubo volcano mouse, Apomys sacobianus.

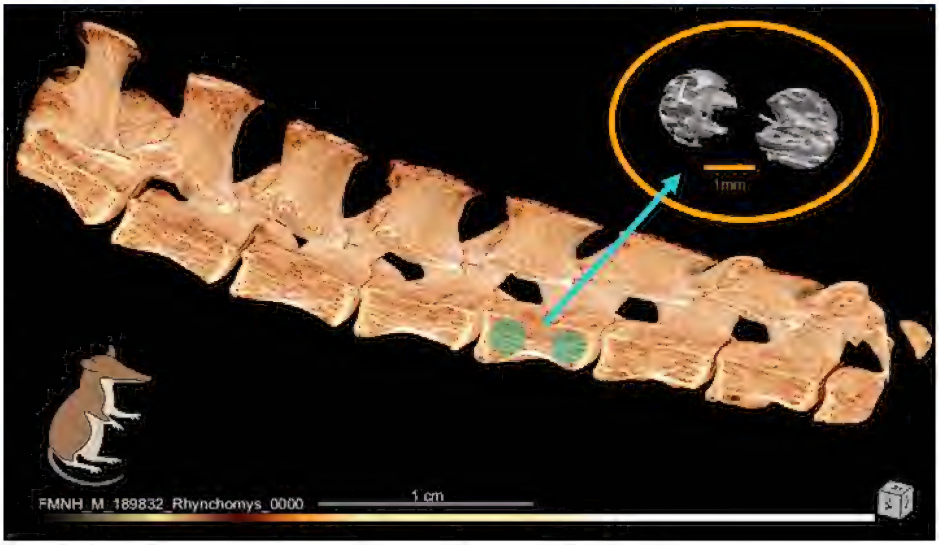
DS BALETE



STEPHANIE SMITH

(Left) Overall body size (shown vertically) and manner of moving (shown horizontally) are likely to impact bone structure in rodents.

(Below) 3D image from a CT scan of the lower spine of an earthworm mouse, Archboldomys maximus.



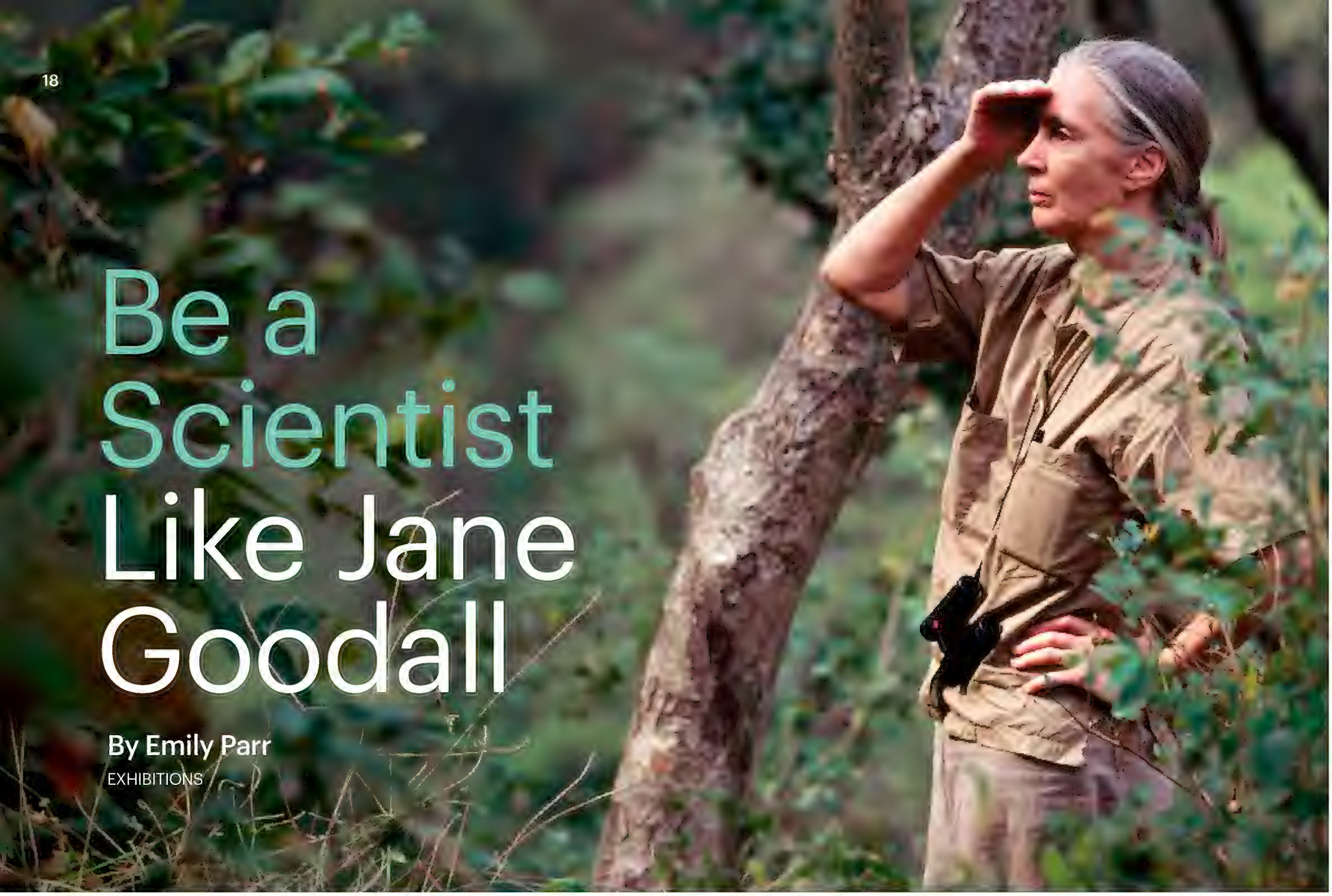
BIOMECHANICS OF BONES

BY STEPHANIE SMITH, PHD, WOMEN IN SCIENCE POSTDOCTORAL FELLOW, NEGAUNEE INTEGRATIVE RESEARCH CENTER

Much of our understanding of how mammals' bodies work is based on lab experiments, using model organisms like lab mice. While these animals are specifically bred for uniformity, they don't really allow scientists to study the affects of natural variation in a group. To answer more complex questions like how size affects skeletal evolution and how skeletal shape is related to movement, scientists need the kind of sample naturally evolving lineages provide.

For example, it has been proposed that the skeletons of small animals are adapted for bone stiffness (resistance to bending) rather than strength (resistance to breaking). The diverse cloud forest rodents of the Philippines offer an excellent "natural experiment" for investigating these questions.

Negaunee Curator of Mammals Larry Heaney, PhD, and his colleagues have been working with mammals in the Philippines for more than three decades, and have amassed a mountain of data on previously unknown, beautiful, unique animals—including two rodent groups (cloud rats and earthworm mice) ideal for studying how skeletons are shaped by body size and ecology. Using cloud rats, we can test how body size affects bones irrespective of ecology—cloud rat species range from 17g-2700g in mass, but all of them are tree-dwelling. With earthworm mice, we can examine how ecology affects the skeleton, irrespective of body size. Many species of earthworm mice weigh 100g, but display many different behaviors: digging, hopping, and terrestrial walking. Using x-ray CT scans, and the Field's superb Philippine mammal collections, my colleagues and I are investigating the shape and function of vertebral bones in the lower back, which are a big part of locomotion in four-legged animals. We're taking measurements of bone shape, and building 3D models of the bones and subjecting them to virtual forces to see how they respond. From there we can see how shape translates into adaptation for strength or stiffness, and also how locomotor ecology plays a role. Although we're studying these phenomena in Philippine rodents specifically, what we learn in the Philippine rodent ecosystem will be useful for testing hypotheses about skeletal function in small mammals from around the world!



MICHAEL NICHOLS, NATIONAL GEOGRAPHIC

Be a Scientist Like Jane Goodall

By Emily Parr
EXHIBITIONS

When Jane Goodall was a child she dreamed of working with wild animals, and her incredible journey to do just that is presented as part of the exhibition *Becoming Jane: The Evolution of Dr. Jane Goodall*. But after years of astounding and revolutionary scientific discoveries, she made a concerning one.

At a scientific conference in 1986, Dr. Goodall learned that wild chimpanzees throughout Africa were in danger of disappearing. And at that moment she decided to transition away from the field work that had absorbed much of her life for the previous 26 years to focus on conservation and activism.

The problems facing wild chimpanzees are the same problems facing much of the natural world–destruction inflicted by humans to habitats and animals. Many of the problems are complicated, interconnected, and worldwide. It may seem overwhelming or impossible for one person to imaging tackling, but Dr. Goodall's approach provides a model.

The Jane Goodall Institute has worked not just with surface issues, but has striven to identify the root causes of destructive practices and also to address important needs of local communities. The work relies heavily on science-based decision making, and on community-driven efforts. Looking to the future Dr. Goodall sees numerous reasons for hope.

Here at the Field Museum, our staff and scientists are always working with that same mission in mind. We continually pursue new ways to learn more about the world around us, conserve and preserve our natural world, and make our data and collections more widely available to everyone. And we don't do it alone. There are many ways you can help be part of that work, out in nature or even right from your home!

—

An exhibition organized and traveled by the National Geographic Society in partnership with the Jane Goodall Institute.

NATIONAL GEOGRAPHIC

the Jane Goodall Institute

(Opposite) Jane Goodall, 35 years after her original observations, finding great joy in watching the Gombe chimpanzees. Gombe National Park, Tanzania.

(Below) A young Chicago resident plants coneflowers in her neighborhood's native garden.

A Monarch butterfly perches on flowers in the Rice Native Garden outside the Field Museum.

EXPLORE: COMMUNITY SCIENCE AT THE MUSEUM

Monarch Community Science Program

Monarch butterfly populations have declined over 80% in the last two decades. The data collected by community scientists, like yourself, helps researchers at the museum understand how milkweed plants in cities and towns are providing habitat for monarch caterpillars. Training sessions are run online in May and June, and monitoring happens throughout the summer. For more information or to get involved visit bit.ly/monarchmonitors.

Collections Club

Collections Club welcomes community scientists (like you!) to explore, curate and digitize Field Museum specimens. Go behind the scenes and take a closer look at specimens and digital records with hands-on curation activities with our scientists. This information helps scientists with their research by accelerating discovery and documentation of the natural world. To learn how you can become involved, visit fieldmuseum.org/collectionsclub or email WeDigBio@Fieldmuseum.org

Volunteer Habitat Restoration

Creating a better world starts in our own backyard. Volunteer with us in Beaubien Woods—every first Saturday of the month, 10am–1pm—to help improve the health of Chicago's natural areas and our communities. For more information on volunteering with our habitat restorations, email calumet@fieldmuseum.org.

FOR THE KIDS

Youth Conservation Action

We offer a variety of opportunities for Chicago's youth and families. The Field's Youth Conservation Action programs help young people from 3rd grade through high school (and beyond!) make an impact where they live. Plus, they can explore future career paths in the environment and sciences. For more information or to get involved email the Keller Science Action Team at action@fieldmuseum.org.

(Left) Specimens of sand shiner fish in the Field Museum's collections collected in 1972, 1953, and 1907.

(Below) A thin, thread-like strand of microplastic from a fish's digestive tract.

70 YEARS OF PLASTIC IN THE WATER

BY KATE GOLEMBIEWSKI, PUBLIC RELATIONS

Forget diamonds—plastic is forever. It takes centuries for plastic to break down, meaning nearly every piece of plastic ever made still exists in some form today. We've known for several years that large pieces of plastic, like grocery bags and six-pack rings, can harm wildlife. However, more recently, scientists have discovered microscopic bits of plastic in the water, soil, and even the atmosphere. To learn how these microplastics have built up over the past century, researchers examined the guts of freshwater fish preserved in museum collections.

"For the last 10 or 15 years, it's been in the public consciousness that there's a problem with plastic in the water. But really, organisms have been exposed to plastic litter since plastic was invented, and we don't know what that historical context looks like," said Tim Hoellein, PhD, an associate professor of biology at Loyola University Chicago and the corresponding author of a new study in Ecological Applications.

Collections Manager of Fishes Caleb McMahan, PhD, cares for some two million fish specimens, most of which are preserved in alcohol and stored in jars in the Museum's underground Collections Resource Center. "We can never go back to that time period, in that place," said McMahan, a co-author of the paper. "That's why these specimens are so important. They're a snapshot of life on Earth."

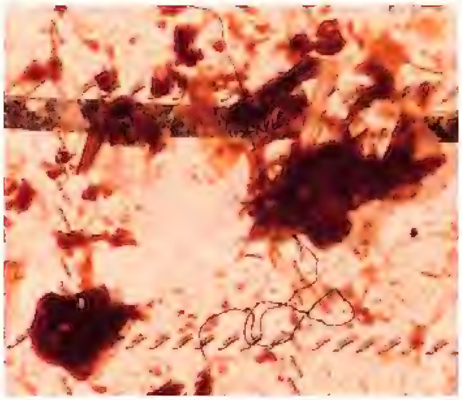
To find the plastic in the fishes' guts, Hoellein's graduate student and lead author of the paper Loren Hou treated the digestive tracts with hydrogen peroxide. "It bubbles and fizzes and breaks up all the organic matter, but plastic is resistant and is left behind," said Hou.

Microplastics are too tiny to see with the naked eye. To confirm the identity of these and determine where they came from, Hou and Hoellein worked with collaborators at the University of Toronto to examine the samples using Raman spectroscopy, a technique that uses light to analyze the chemical signature of a sample.

The researchers found that the amount of microplastics present in the fishes' skyrocketed since humans began manufacturing plastics in the 1950s.

"Microplastics can come from larger objects being fragmented, but they're often from clothing," said Hou—whenever you wash a pair of leggings or a polyester shirt, tiny little threads break off and get flushed into the water supply.

"It's plastic on your back, and that's just not the way that we've been thinking about it," says Hoellein. "So even just thinking about it is a step forward in addressing our purchases and our responsibility."



LOREN HOU

The Grainger Science Hub is made possible through the generosity of The Grainger Foundation.

EXPLORE:

Science Action in the *Grainger Science Hub*

Get a glimpse into the important work of the Field Museum's Keller Science Action Center on your next visit to the Field. This exhibit highlights the important conservation initiatives both around the Chicagoland area and in the Andes-Amazon—home of the greatest diversity of species on the planet. The Keller Science Action Center protects and restores Earth's environments by empowering local communities to take action and catalog their knowledge. Learn how you can take part in local conservation, too!

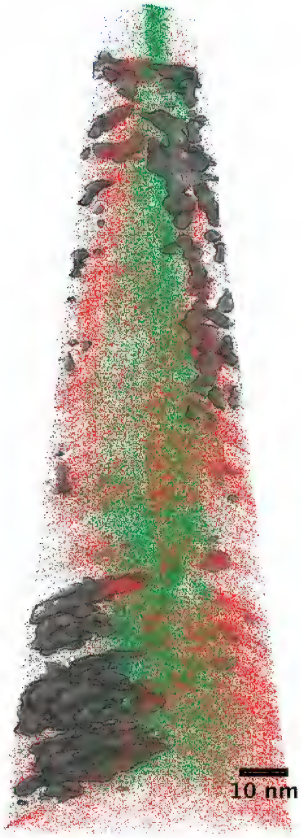
Also in the *Grainger Science Hub* is an exhibition on Zoonotic Diseases. Learn about the transmission of diseases, like COVID-19, from animal hosts to humans, and explore how Field Museum scientists are contributing to disease research.

See both before they're gone!

The Grainger Science Hub is open from 11am–3pm, Thursday–Monday. For the safety of our guests and staff there is a capacity limit of 10 people in the space at a time, but no ticket is required. Like the rest of the Museum, masks are required to enter and cleaning is frequent.

(Left) Staff from the Field Museum and the Museum of Science and Industry—the original owner and lender of the Northwestern University atom probe—finish installation in the Searle Family Lounge.

(Below) Reconstruction of meteoritic nanodiamonds analyzed with atom probe. Shaded grey areas enclose carbon atoms which form individual and clusters of nanodiamonds. Green and red atoms are from the supporting structure on which the diamonds were placed before analysis.



PHILIPP R. HECK

DIVE DEEP INTO OUR COSMIC ORIGINS WITH THE ATOM PROBE

BY PHILIPP HECK, PHD, ROBERT A. PRITZKER CURATOR FOR METEORITICS AND POLAR STUDIES AND GRADUATE STUDENT **JENNIKA GREER,** NEGAUNEE INTEGRATIVE RESEARCH CENTER

Studying samples from one of the world's largest meteorite collections at the Field Museum's Robert A. Pritzker Center for Meteoritics and Polar Studies enables scientists to trace back our origins to 4.6 billion years ago, before the planets were formed. Some meteorites have remained unaltered since that and have preserved material that is even older, called "presolar."

This is interesting to scientists because knowledge of the chemical composition of presolar material reveals whether it formed in the outflows of stars—as real stardust. Small diamonds are among the most common types. Because of their tiny size of only a few nanometers, they are called nanodiamonds. These minuscule diamonds are about 50 times smaller than the SARS-CoV-2 coronavirus, and because of this, are difficult to study. Like all diamonds, they are carbon crystals—a three-dimensional, symmetrical arrangement of carbon atoms. They are much too small to be seen in a regular light microscope and analyzed with conventional methods.

Our team uses an atom probe, which is a device that has been specifically designed to analyze tiny samples on an atomic scale. Atom probes provide us with a 3-dimensional view of the sample, atom by atom. Knowing the type of carbon isotope the crystal was built with is key. We compare the types of carbon atoms in the diamonds with the ones in stars to find the best match. While all stable forms of carbon formed in the interiors of stars, so far, our work shows that only 5% or less of the nanodiamonds formed directly from stars, whereas the rest may have formed directly from the cold cloud of gas and dust that coalesced to form the Sun, planets, asteroids, and comets. Our team has also used the atom probe to study moon dust, iron meteorites, and other types of presolar materials.

It is fascinating to realize that the carbon atoms in the food of your next meal have their origin in the interiors of stars, just like the carbon in the nanodiamonds, and are at least 4.6 billion years old. The main difference is that the carbon in your meal has been recycled into different compounds—many more times than the nanodiamonds.

We invite you to take a close-up look at an atom probe originally used at Northwestern University's Material Research Center, a temporary exhibition through March 2022 in the Searle Gallery Family Lounge.

This exhibit is organized by Northwestern University's Material Research Center.

Support is provided by the National Science Foundation Materials Research Science and Engineering Center Program (DMR-1720139), Northwestern University Office for Research, and Alumnae of Northwestern University. This research is supported by the TAWANI Foundation and by NASA Cosmochemistry and Emerging Worlds Grants.

The Field Museum is grateful to the Searle Family for their support of the Searle Family Lounge.

THE MYSTERY OF THE QUARTZ CRYSTALS AND THE FOSSIL BIRD

BY KATE GOLEMBIEWSKI, PUBLIC RELATIONS

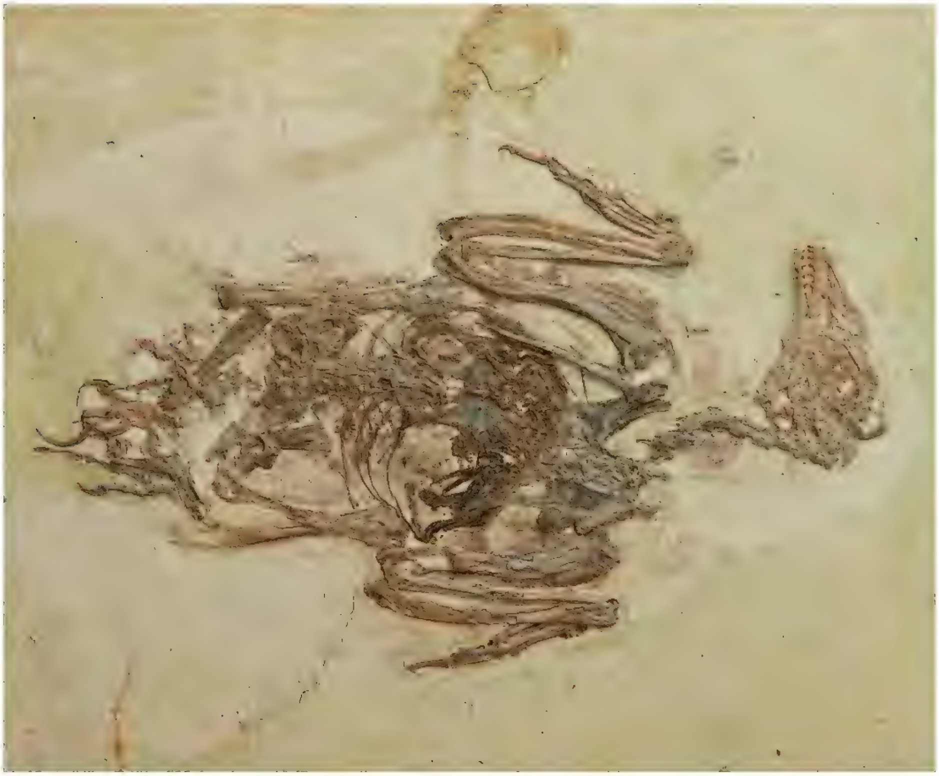
The diets of a group of fossil birds called the Enantiornithines are a mystery. In the thousands of finely preserved fossils from China's Jehol Formation, no one's ever found a specimen with preserved stomach contents. But Associate Curator of Fossil Reptiles Jingmai O'Connor, PhD, found something puzzling in one specimen's stomach: quartz crystals.

Previously, scientists had found rocks in the stomach of a pigeon-sized fossil bird called *Bohaiornis* and thought it might have swallowed them on purpose. Some birds swallow stones called gastroliths to help them crush up tough food like plant materials or dislodge material from their digestive tracts. But O'Connor wasn't so sure: the rocks were the wrong shape and size, and they looked to be all the same material, which is rare for gastroliths.

To test her hypothesis, O'Connor's team at China's Institute of Vertebrate Paleontology and Paleoanthropology extracted a sample of the rocks in *Bohaiornis*' stomach and examined them under a scanning electron microscope. They then exposed the rocks to X-rays to determine which wavelengths the rocks absorbed. Since each mineral absorbs different wavelengths, this helped the researchers narrow down what these rocks were made of. They discovered that the "gastroliths" were actually a thin sheet of chalcedony, a kind of quartz crystal that's known to form in fossils. What's more, when they compared the quartz crystals with gastroliths from other birds and dinosaurs, the crystals were far more massive.

The combined evidence suggests that *Bohaiornis* didn't consume gastroliths to help crush food or clean its stomach after all. Or, at least, this individual specimen doesn't contain those kinds of gastroliths. This means it's back to the drawing board with theories about what *Bohaiornis* ate.

S. ABRAMOWICZ, DINOSAUR INSTITUTE, NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY



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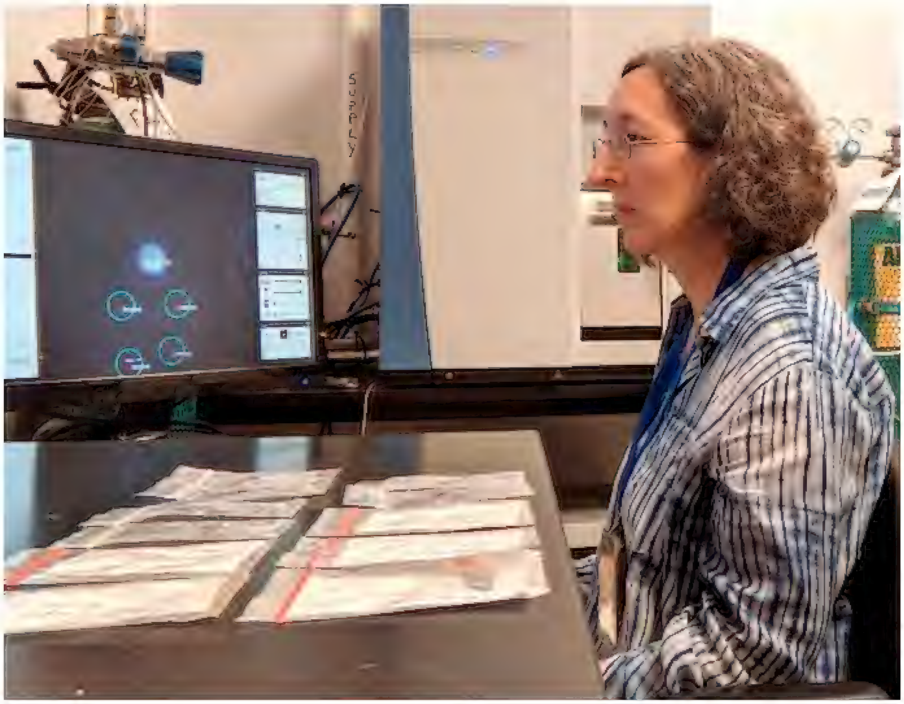
That's not a bad thing, says O'Connor: "It's just part of the paleo game, part of science—constantly correcting. I'm happy when we don't understand things, because it means there's research to do, it's exciting."

(Top) A reconstruction of the bohaiornithid Sulcavis, a close relative of Bohaiornis guoi, hunting an insect.

(Above) The fossil specimen of Bohaiornis with crystals in its stomach.

what a GLASS BEAD can tell us about ANCIENT ECONOMIES and TRADE



LAURE DUSSUBIEUX

(Opposite) Glass beads from Maliwan, Myanmar.

(Left) Laure Dussubieux carrying out LA-ICP-MS analysis in the Elemental Analysis Facility.

(Below) A string of glass beads collected during the excavations at Kish, 1924. (Catalog Number 228853).

By Laure Dussubieux, PhD

RESEARCH SCIENTIST, INTEGRATIVE RESEARCH CENTER

We tend to think of "mass production" as a modern concept, but in fact it has been around for centuries. India, for example, was a major manufacturer and exporter of glass beads in the ancient world. As early as 500 BC, Indian craftsmen were mass-producing beads—made by drawing molten glass into a thin tube, then slicing the tube into sections. These beads have been found at sites in Southeast Asia, China, Japan, all around the Indian Ocean, and especially in Southern and Eastern Africa. Indian beads were also discovered in Early Medieval graves (5th to 8th century) of western Europe where they were quite likely sewn into clothing.

I have been conducting research on Indian glass beads for more than two decades in the Field Museum's Elemental Analysis Facility. I use laser ablation (the process of removing material from a solid surface by targeting it with a laser beam) mass spectrometry to determine the composition of ancient materials and to obtain the concentrations of their major, minor, and trace elements. In my work, the composition of glass objects tells us what kind of recipes glassmakers used in the past. The trace elements can even help distinguish different workshops that followed the same recipe but used different raw material sources. But, the chemical composition of these beads tells a larger story, including a chronological shift in production regions, and changing patterns of distribution.

The bulk of my research is centered in the Kra Isthmus—the narrowest part of the Malay Peninsula. It is separated by the Thailand-Myanmar border and constitutes a natural partition between the Bay of Bengal and the South China Sea, which were two important exchange spheres in ancient time. By examining the glass material excavated at different sites by my colleague Bérénice Bellina (Centre National de la Recherche Scientifique, France) and researchers from Thailand and Myanmar, we discovered that Indian bead making technology was transferred from Northern India to sites in Thailand, and production was distributed around the South China Sea as early at the 4th to the 2nd century BC. This connection disappeared around the 2nd c. BC and was replaced by a Bay of Bengal network that encompassed several sites in India, Myanmar and Thailand. There is also evidence of a dominant trade network originating in South India and Sri Lanka that distributed glass in Southeast Asia and around the Indian Ocean.

Thus, these glass recipes help us reconstruct ancient trade networks, which in turn illuminate changes in trade and shifts in primary civic centers. For example, beads in the Field's collection from the ancient site of Kish in Iraq came from India through the Persian Gulf, and quite likely followed the Euphrates at various points between 500 and 1300 AD. All in all, these beads made their way across the known world—indicating that 1500 years ago, not only were mass-produced goods widely distributed, but even then, people were living in a global economy.

Save the Date!

Field Museum Giving Day is Wednesday, September 29, 2021

BECOME A GIVING DAY AMBASSADOR

Last year, several members like you chose to become Field Museum Giving Day Ambassadors and raised more than $45,000 by engaging their personal networks to help our work.

Will you consider becoming a Giving Day Ambassador and help raise essential support for your Museum?

Giving Day Ambassadors who raise a minimum of $50, receive our exclusive Centennial commemorative t-shirt!

Share your favorite stories about our 100-year old building with friends and family; help us spread the word about Giving Day 2021.

Visit fieldmuseum.org/givingday to sign up as a Giving Day Ambassador. Contact us at membership@fieldmuseum.org or 312.665.7700

Member Opportunities

EXCLUSIVE EARLY ENTRY FOR MEMBERS AND DONORS

Saturdays through September 4, 8–9:30am

Members can enjoy exclusive early entry on Saturdays. Stroll through your favorite exhibitions and enjoy quiet moments in our smaller galleries before the Museum opens. This is also the perfect time to visit our newest exhibition, *Becoming Jane: The Evolution of Dr. Jane Goodall.*

FIELD MUSEUM: 100 YEARS ON MUSEUM CAMPUS

Wednesday, August 11, 6:30–7:30pm CDT (Virtual)

2021 marks the centennial of the Field Museum's lakefront home, the first building on what is now known as the Museum Campus. Over a century the Campus has morphed and changed—from the addition of two other cultural institutions to controversial decisions to conservation along the lakefront. The Field Museum has had a front-row seat to all these changes since the beginning.

Join experts from the Field Museum, Chicago Architecture Center, and Chicago History Museum, in an exclusive virtual event as they share stories of Museum Campus over the past 100 years.

Featuring:
Carter O'Brien, Sustainability Officer, Field Museum
Maurice Champagne, Docent, Chicago Architecture Center
Peter Alter, Chief Historian and Director of the Studs Terkel Oral History Center, Chicago History Museum

THE MACHINE INSIDE: BIOMECHANICS MEMBER PREVIEW DAYS

Wednesday, September 1 and Thursday, September 2, 9am–4pm (In-person)

Members are invited to see the return of our most popular traveling exhibition before it opens to the public. Preview day tickets will be available online in late August—full details will be sent in the weekly member e-newsletter.

CENTENNIAL CELEBRATION

Saturday, October 2 (In-person)

Join us at the Museum and help us celebrate 100 years in our lakefront home. Our scholars will be onsite to showcase their work, show specimens from our collections, and discuss the past, present, and future of the Field.

More details about this celebration will be available in September.

WILD COLOR MEMBER PREVIEW DAYS

Wednesday, October 20 and Thursday October 21, 9am–4pm (In-person)

Members are invited to view this brand new exhibition before it opens to the public. Preview day tickets will be available online in October—full details will be sent in the weekly member e-newsletter.

Don't miss a moment!

Exclusive member events happen every month and the most complete details are sent in the weekly member e-newsletter. To add or update your email address, email membership@fieldmuseum.org or call 312.665.7700.

Museum Hours

The Field Museum is open seven days a week from 9am to 5pm, with last admission at 4pm. Members can enjoy exclusive early entry on Saturdays from 8-9:30am with advanced registration. **For the most up to date information, parking, and public transportation options, visit fieldmuseum.org/visit.**

The Field Museum salutes the people of Chicago for their long-standing support of the Museum through the Chicago Park District.

UNITED AIRLINES

Official Airline of the Field Museum

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Black History Month
in Chicago

Montenegro is proud to be a partner and sponsor in the celebration of Black History Month at the Field Museum of Natural History.

For 25 years Montenegro has been commited to diversity, multicultural social teamwork and community groups.

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